LIVERMORE LAB
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Nov. 14-18, 2011.

COMPUTERWORLD GO BIG OR GO HOME

The Dawn supercomputer (IBM BlueGene P) in the Terascale Simulation Facility the Laboratory.

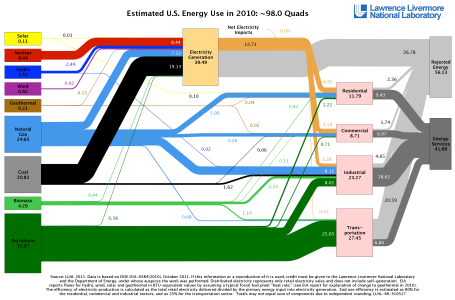
There was an almost obsessive focus at the supercomputing conference this week on reaching exascale computing, a level of computing power that is roughly 1,000 times more powerful than anything that is running today.

Something that is eight or nine years off may seem like a long time, but at SC11, it feels as if it is just around the corner. Part of the push is coming from the Department of Energy, which will fund these massive systems. DOE told the industry this summer that it wants an exascale system delivered in the 2019-2020 timeframe that won't use more than 20 megawatts of power.

To put 20 megawatts of power in perspective, consider the supercomputer that IBM is building for the Laboratory. This system will be capable of speeds of 20 petaflops. It will be one of the largest supercomputers in the world as well as one of the most energy efficient. But when it becomes operational next year, it will still use somewhere in the range of 7 to 8 megawatts of power, according to IBM. An exascale system has the computing power of 1,000 petaflops. (A petaflop is a quadrillion floating-point operations per second.)

To read more, go to *Computerworld*.

AMERICANS EAGER TO STEP ON THE GAS



The nation is using more coal, petroleum and natural gas than in previous years, according to the most recent energy flow charts released by the Laboratory.

American energy use went back up in 2010 compared to 2009, when consumption was at a 12-year low. The United States used more fossil fuels in 2010 than in 2009, while renewable electricity remained essentially constant, with an increase in wind power offset by a modest decline in hydroelectricity.

"We are still seeing the capacity additions from a wind energy boom come online," said. A.J. Simon, an LLNL energy systems analyst who develops the flow charts using data provided by the Department of Energy's Energy Information Administration. "And renewable fuel mandates are driving the consumption of ethanol by cars and trucks."

Overall, U.S. energy use in 2010 equaled 98 quads of BTUs compared to the 94.6 quads of BTUs used in 2009. Most of the energy was tied to coal, natural gas and petroleum.

The majority of energy use in 2010 was used for electricity generation (39.49 quads), followed by transportation, industrial, residential and commercial consumption. "This is just a snapshot of how the energy system was used," Simon said. "Although it doesn't appear to change much from year-to-year, even small shifts can have big consequences for certain sectors of our economy."

To read more, go to *USA Today*.

TURN DOWN THAT NOISE

A National Oceanic and Atmospheric Administration (NOAA) weather satellite. Image courtesy of NASA.

In order to separate human-caused global warming from the "noise" of purely natural climate fluctuations, temperature records must be at least 17 years long, according to climate scientists.

To address criticism of the reliability of thermometer records of surface warming, Laboratory scientists analyzed satellite measurements of the temperature of the lower troposphere (the region of the atmosphere from the surface to roughly five miles above), and saw a clear signal of human-caused warming of the planet.

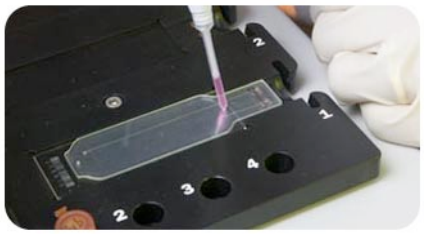
Satellite measurements of atmospheric temperature are made with microwave radiometers, and are completely independent of surface thermometer measurements. The satellite data indicate that the lower troposphere has warmed by roughly 0.9 degrees Fahrenheit since the beginning of satellite temperature records in 1979. This increase is entirely consistent with the warming of Earth's surface estimated from thermometer records.

Recently, a number of global warming critics have focused attention on the behavior of Earth's temperature since 1998. They have argued that there has been little or no warming over the last 10 to 12 years, and that computer models of the climate system are not capable of simulating such short "hiatus periods" when models are run with human-caused changes in greenhouse gases.

"Looking at a single, noisy 10-year period is cherry picking, and does not provide reliable information about the presence or absence of human effects on climate," said Benjamin Santer, a Lab climate scientist and lead author of new research in the *Journal of Geophysical Research (Atmospheres)*.

To read more, go to the *Physorg.com*.

AN ARRAY OF HOPE FOR DETECTING BACTERIA



The Lawrence Livermore Microbial Detection Array, which contains 388,000 probes that are used to detect viruses and bacteria.
Photo by Jacqueline McBride/LLNL

Lab researcher Tom Slezak is one of a team of scientists who has developed a microarray technology for detecting bacteria and viruses. This technology is used to help researchers at the San Francisco Blood Research Institute take a hard look at what's really in some vaccines.

"We found that one of the vaccines had nucleic acid from another agent that wasn't expected to be there," he said. "It turns out that it was present through two years of human clinical testing and four years of worldwide sales, and nobody knew that there was actually more nucleic acid from this virus than there was from the virus that was there for the protective vaccine. And this actually caused the FDA (Food and Drug Administration) to think a little bit differently about these new technologies."

The Lab's device also could be used for detecting bioterrorism attacks and for doctors diagnosing diseases.

To hear the interview, go to *Science Today*.

LIVERMORE LAB REPORT TAKES A BREAK

In observance of the Thanksgiving holiday next week, the *Livermore Lab Report* will take a break. It will return on Dec. 2.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

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